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AUTHOR Chi-chung, Lam; Yun-peng, Ma; Ngai-ying, Wong
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ABSTRACT

Chinese researchers investigated how mathematics teachers in two elementary schools in northeast China adapted the national curriculum. One school was in a very poor, mountainous area, and the other school was in a very large city. Both used the national curriculum and the same set of teaching materials. Researchers used ethnographic methods to collect data. Over 4 weeks, they conducted formal and informal interviews with teachers and principals, chatted with students, observed lessons, collected in-house curriculum documents (e.g., lesson plans and work schemes), and attended staff meetings and subject panel meetings. Results indicated that teachers in both areas closely followed the requirements of the textbooks and suggestions of the teacher reference book. Teachers had a strong influence on how the subject was planned and delivered. Their decisions were based on professional knowledge, educational beliefs, and the public examination. There were some marked differences between urban and rural schools in the way teachers adapted the curriculum and teaching materials. There were obvious differences in terms of school culture between the two areas. Teacher development was crucial to successful curriculum change. (Contains 11 references.) (SM)

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Lam Chi-chung
Associate Professor, Curriculum and Instruction Department,
Chinese University of HK

Ma Yun-peng
Ph.D Candidate, Curriculum and Instruction Department,
Chinese University of HK

Wong Ngai-ying
Associate Professor, Curriculum and Instruction Department,
Chinese University of HK

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Teacher development, not accountability control, is the key to successful curriculum implementation: A case study of two primary schools in northeast China

Lam Chi-chung, Ma Yun-peng, Wong Ngai-ying

Objectives and purposes

China has, for a long time, adopted a center-periphery curriculum development system. Most schools, except those in Shanghai and Zhejiang, followed the national curriculum. However, the economic and social environment of different parts in China varies significantly. How does the Government ensure that the centrally developed curriculum is adopted and implemented in the preferred manner? How far is the implementation strategy successful? If not, what is needed to make it successful?

The present research attempts to answer these questions by studying how mathematics teachers in two schools in the province of Jilin adapted the curriculum.

Theoretical framework

China, being a large country, faces serious problems in implementing curriculum change. But curriculum implementation is a neglected area of curriculum research in China Mainland. A literature search through the Chinese ERIC shows that only one piece of work on curriculum implementation appears in educational journals in the Mainland.

Curriculum implementation studies have a fairly short history. In the 70s and 80s, numerous implementation studies in the western world have helped educators and teachers gained more insight into the mechanics and the complexity of implementation process. Fullan (1991) claims that we have gained a fairly good knowledge of what works in curriculum implementation.

Researches show that the implementation of curriculum is affected by a wide range of factors including the nature, clarity and complexity of change, the support of the local education authority, the quality and involvement of the teaching force, the participation of school principal, the culture of teachers, the support of the central government etc (Fullan, 1991; Nias, 1992; Snyder & Zmwalt, 1992). Among these factors, teachers play an important role, particularly at the classroom level (Fullan, 1991, Clark, 1997). Teachers seldom implement a curriculum exactly in the way stated in curriculum documents. Instead, they adapt the change. Therefore, studying teachers' decision making process can help us understand the change process.

Teachers are said to adopt a practical stance in deciding what to teach and how to teach. Their decisions are affected by their knowledge, belief and school culture (Calderhead, 1996; Clarke, 1997; Hargreaves, 1992; Nespor, 1987). Teachers without sound professional knowledge will have difficulties in adapting a curriculum.

Teachers' attitudes and beliefs are also important. Competent teachers feel that they are capable to shape student performance and they have high expectations of the students (see Tuckman, 1995).

Another factor which affect teachers' curriculum decisions is high stake examination (see for example, Mathematics Education Dialogues, May/June, 1998). The influence of examination on teachers is very strong in China Mainland (see for example, Zhang & Ren, 1998).

With the understanding of implementation study findings, the research team embarked on the study of two case schools.

Research methodology

Case selection

The present study is a case study of the implementation of mathematics in two primary schools in northeast China. The two case schools were in Jilin province. One was in a poor, mountainous area. There was not even a telephone in the village. The other case school was in Changchun, the largest industrial city in Jilin. These two schools contrasted sharply in size, background, intake of students and availability of resources. But they both adopted the national curriculum and used the same set of teaching materials. The reason for choosing two schools in the same province was that they were under the same provincial administration. The major difference between them was that one was in poor rural area and the other was in industrial urban area. The socio-economic differences between rural and urban areas could be highlighted. Of course, these two case studies could not be projected statistically to represent all schools in China. Nevertheless, they could reflect the implementation of mathematics curriculum in the northeast China.

The urban school was large, with over 38 classes, 2200 students and 85 teachers. The intake of students was good. Teachers were divided into subject departments and they specialized in the teaching of one subject only.

The rural school was small, with only eight classes, 177 students and 12 teachers. Each class was assigned a class teacher who took up mathematics, language music and physical education. For other subjects such as art, the work was shared between other teachers and the school principal.

Data collection and analysis

In this study, we used ethnographic methods to collect the data required in a naturalistic setting. A member of the research team stationed in each case school for four weeks. During the field work period, the researcher conducted a range of formal and informal interviews with the teachers and the school principals, "chatted" with students, observed lessons, collected in-house curriculum documents including lesson plans and schemes of work, and attended staff meetings and subject panel meetings. The purpose was to look deeply into teachers' curriculum decision-making in light of the implementation of mathematics curriculum. The long period of fieldwork made it easy for the researcher to establish good rapport with the teachers and the administrators.

Teachers and the school administrators were informed that the study was meant to be illuminative rather than evaluative.

In the urban school, we chose to focus our study on the teachers who taught Grade 3 mathematics. Their lessons were observed and they were interviewed. However, we did select one or two teachers from each grade level for classroom observations and interviews. For the rural school, all mathematics teachers were objects of research since there was only one teacher for each grade. Further, school principals and subject heads were interviewed. Details of teachers studied are shown in Table 1.

Table 1 The background of the teachers

Teacher	Sex	Education Background (Initial)	Education Background (Current)	Grade responsible	Years of Teaching Experience
I-A	F	A	E	3	17
I-B	M	A	E	3	5
I-C	F	A		3	2
I-D	F	A		3	4
I-E	F	B		4	9
I-F	F	A		2	4
I-G	F	A		5	33
I-H	F	A	E	6	17
I-I	F	A		1	5
II-A	F	A		1	1
II-B	M	C	F	2	24
II-C	F	D		3	13
II-D	F	D	F	4	19
II-E	M	D		5	15
II-F	M	D		6	Supply

Note: I denote the urban school, II denotes the rural school
A = Teacher Training School.
B = Specialized Secondary School.
C = Junior Secondary School.
D = Senior Secondary School.
E = Specialized Subject.
F = Specialized correspondence Secondary School.

A total of twenty-six lessons were observed, fifteen teachers and the two school principals were interviewed formally. Each interview lasted 30 to 60 minutes. The formal interviews were recorded and transcribed in full. The data, including the lesson plans, classroom observation records, the interview transcripts were read through to identify themes related to the implementation processes and teachers' decision-making.

Findings

Teachers followed the requirements of the textbooks and suggestions of the teacher reference book

Based on the classroom observation data, we found teachers in the two case schools tended to follow the sequence of the content of the textbooks which was published by the People's Education Press, the semi-official and the largest textbook publisher in China Mainland. The illustrations, examples and exercises in the textbooks were used. Changes made by teachers from the rural school were minimal.

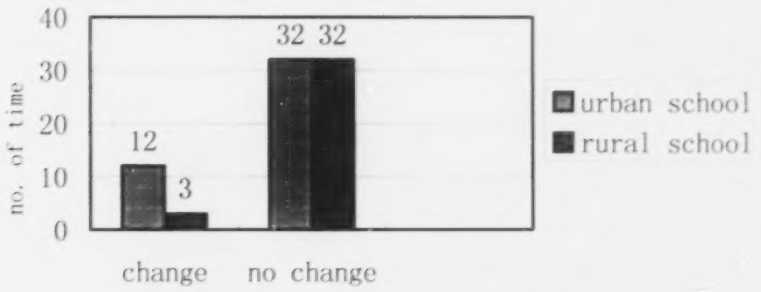

Figure 1 Selection of teaching content

It was revealed from the interviews that teachers depended heavily on the textbooks and the accompanied teacher reference books in preparing their lessons. The following extracts from the interview transcripts illustrate this,

M(Researcher): What are the references you use in preparing your lessons?
I- C: Textbook is the major reference.

M: How do you prepare your lessons?
I-C: I prepare myself by reading textbooks. After reading the textbooks, I shall consider whether the students have learnt it and how well they have learnt. And then I shall think over the new lesson, design the exercises, and I shall also assess how well the students have learnt after a lesson. (ASFT5-1) (Note 1)

M: What are your major considerations in preparing lessons?
I- F: The most important thing is the teacher reference book.
M: When you decide to use this teaching method, you take the idea from the teacher reference book?
I-F: Yes.
M: What are the other considerations besides the teacher reference book?
I- F: Read the textbooks. The examples in the textbook are fairly easy. There is a structure of the content in each year's textbook. It progresses from one year to another ..... However, the methods are very much the same.

M: How do you write your lesson plan?

II-B: Following the format in the teacher reference book (Teacher showed the lesson plan.) The general format includes the topic of the lesson, number of pages, the main ideas and difficult points, and whether it is a new topic or revision. Basically, it is simple.
M: How do you prepare your lesson?
II-B: (I) write the lesson plan. (I) prepare the lesson according to the requirements of the textbook and then deliver as the lesson plan. (BSFT3-1)

Reasons for following the teaching materials

Why were teachers inclined to follow closely the textbooks and the teacher reference books? This was largely due to the importance of examination and its impact on teachers. Nearly all school principals and teachers interviewed mentioned the pressure of examination on them, and how that influenced their instructional design and their classroom teaching.

Three themes relating to this point can be identified from the data we gathered:

1. Teachers rate the importance of content according to the examination requirement:

   Teacher I-A was a typical example. When he discussed the content selection of his lesson with the researcher, he said,

   M: Estimation is optional in the syllabus. How do you handle
   I-A: I think, this is not included in the (county public) examination. As long as students understand it, it is fine. There is no need to give them exercise.

   Another teacher's view can also illustrate this thinking:

   M: How is the amount of exercise?
   II-B: There are a lot. I have to spend almost every afternoon to supervise students on this. This is a heavy load for students. However they have to do it since the examination is coming. We are unsure of the type of questions, so we want students to do more. (BSFT4-1)

2. Students' performance is judged by their examination result.

   M: How would you deal with students of less ability?
   I-E: During the course of the year, we depend on students of higher ability to help them. At the end of the term, The higher ability students would design some exercises for the less able students. The effect is quite good. To the higher ability students, it is also a training process. For the three least able students, I have to help them individually. (ASFT9-2)

   II-E: (We must) make sure that the result of the county public examination is fine. (To achieve this), we cannot just focus on the good students. We also need to take care of the poor students. If there were a few students who get over 90 marks but some only get 20 marks, our result will still be poor on average. The poor students should, at least, get 40 marks.

3. Assessing teacher performance by students' examination.
The following two extracts elaborated this point:

> M: How do you get to know the standard of your students?
> I-I: There are not many ways to do it. (We) still depend mostly on examination (result). Teachers do observe each other's lessons. But from the point of school, it is impossible to have every class observed. So (students') examination is the major way to understand what happens in classroom. (ASFT15-2)

> II-P (principal): Everyone weighs the examination highly because it relates to the assessment and promotion of teachers. Teachers who produce good examination results are rated excellence, which also means promotion. The teachers are also awarded by the school and by the village. (BSFT1)

As examination had such a great impact on judging teachers' performance and promotion, it is not surprising at all that it was an influential factor in shaping teachers' curriculum decisions. Among the various examinations, the school final examination and the county public examination, had comparatively greater impact on teachers. These two types of examinations were set by experienced teachers or educational researchers in the area. In most cases, these setters followed the content and format of items in the textbooks and the national curriculum. Under such situation, teachers followed closely on the suggested content and structure of the textbook.

Differences between the urban and rural case school

Although teachers from both case schools followed the textbooks and teacher reference books closely, there were some differences between the way teachers adapt the curriculum and teaching materials. Teachers of the urban school were more inclined to increase the amount of exercise. They felt that the exercises in the textbooks were too simple. In order to raise students' standard, they added more difficult questions in their teaching and homework assignment. This reflected the belief of the teachers as well as the competitive culture inside and outside the school. Following are some of the teachers' remarks.

> I- B: Beside the national curriculum, we require student to learn extra materials. These are in general a bit more difficult than the curriculum…

> I-E: Students have to learn division with remainder. This type of problems often appears in mathematics competition. Therefore we need to increase the level of difficulty in exercises. (ASFT8-1)

This belief was common among teachers from the urban school. They felt obliged to give more exercises for their students because they were above average students. At the same time, they often design problems of greater difficulty for students so as to prepare them for various levels of mathematics competition.

On the teaching method used in classroom teachers from the urban and rural school showed marked differences. The teaching methods in urban school were of a great variety while their counterparts in the rural school relied heavily on lecturing and questioning (see Table 2). From the pedagogical point of view, the wide variety of methods used the

urban school provided more and better opportunities for students to think and participate in the learning process, as well as providing more channels and angles of learning through which students could better absorb the materials. When designing class work, teachers from the urban school tended to design tasks, which covered a broader range of difficulties and style. Teachers from the rural school selected tasks from the textbook only.

Table 2 Teaching methods adopted by teachers

Method		Teachers from Urban School (Number of times)	Teachers from Rural School (Number of times)
Lecturing		******	********** **********
Questioning		**	**
Guide student to observe and compare		********	****
Students self-learning under the guidance of teachers		*****	
Students try to tackle exercises		******	
Involving students on hand-on activities		**********	
Student discussion and collaboration in class		********	
Stimulate student to think		*	
Encourage students to raise questions		*******	****
Students tackle questions on blackboard		***	***
Classroom practice	Questions from textbook only	*	******
	Textbook and self-designed tasks combined	*	*
	Designing tasks of various levels of difficulty	******	
	Use different modes of exercises	***	

Note: * denote the times that the teachers talked the item in the interviews.

Why were there such differences? Why did teachers select and use their teaching methods? From the data gathered from interviews and classroom observation, we manage to identify some major considerations of teachers in deciding their teaching methods. These included teachers' professional knowledge, educational beliefs, school culture, and ability level of students and reference books (See Figure 2).

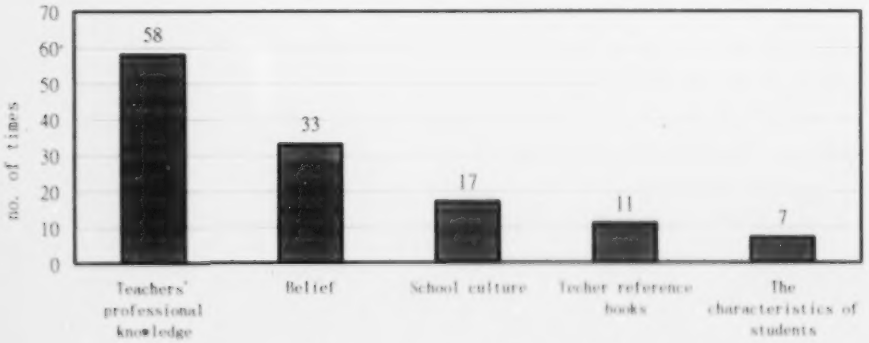

Figure 2 Factors affecting teacher's choice of teaching methods

Professional knowledge of teachers included subject knowledge and pedagogical content knowledge (as defined by Shulman, 1987), and practical knowledge derived from teaching experience. Teachers' beliefs, as suggested by Pajares (1992) and Calderhead (1996), included beliefs on learners' ability, on mathematics and the subject, on learning mathematics, on the role and effect of teachers, etc. School culture included colleague relationships, teaching culture and school atmosphere (Hargreaves, 1992). The characteristics of students refer to the knowledge and ability of the students. By reference books we meant teacher reference books accompanying the textbooks

Similar to the case of deciding the teaching content, suggestions in the teacher reference books were taken into account when they planned the teaching methods. But this alone could not explain why rural and urban school teachers varied so much in their classroom delivery. It is discovered that teacher knowledge, beliefs and school culture can explain the differences.

In terms of professional knowledge, teachers from the urban school had a deeper understanding of the structure and the main/difficult concepts of the teaching content. They were also more experienced. When asked about teaching methods, teachers from the urban school could explain their choices and preferences with certain educational theories. Some teachers from the rural school were experienced and could tell what the students' common mistakes were. Yet they did not quite understand how the textbook was structured and what the main/difficult concepts were. Sometime they did not recognize why the content and the structure were presented in that way in the textbook. For example, a teacher did not know the meaning of an inset diagram, and so decided not to use it (BSFT3-1). Some teachers mistook difficult concepts as easy and straightforward for students and hence then had not paid special attention in finding a way to teach them. This resulted in students finding it hard to digest (BSFT15-1).

Table 3 Teacher Knowledge on Curriculum Decision

Item	School I	School II
Understand the characteristics of the content structure	****	
Understand the major/difficult concepts included in the content	**********	**
Recognize points which students easy to make mistakes	****	***
With certain theoretical knowledge	*****	
With rich experience	*********	***
No clear understanding why the content was structured and presented in the textbook		****

There were also obvious differences in terms of school culture between the two case schools. In the urban school, teachers were required to attend collective lesson planning sessions where teachers of the same subject would discuss the content and teaching methods. Occasionally, they had inputs from education researchers outside school. The situation in the rural school was less desirable. Teachers, like those in Hong Kong (see Lam, 1992), worked in an isolated manner. Moreover, teachers in the urban school

had much more chances to attend courses and training, and participated in in-house research work. With these, their professional knowledge and confidence was much stronger.

Table 4 School Culture on Teachers' Curriculum Decision

Teacher	School I	School II
School Culture Characteristics	Integration of collective and individual lesson preparation Guidance from county education researcher Numerous internal/external exchange with schools Teachers participated in various forms of training Emphasis on education competition School put emphasis on reform studies	Individual lesson preparation by teachers No other guidance No external exchange (internal exchange within school was also minimal) Few training No emphasis on competition No research conducted

The working conditions and the school culture were reflected in teachers' beliefs. Urban school teachers believed that students should learn more and so, besides following the textbook, they increased the amount of difficult problems for students. On the contrary, teachers from the rural school believed that the textbook requirement was too high and their first priority was to complete the required curriculum in time, or with extra amount of time as a matter of fact. Urban teachers showed more confidence in their teaching while rural teachers were lacking in confidence.

Table 5 Teacher Beliefs on Curriculum Decision

Teacher	School I	School II
Major Beliefs	Students learn more Textbook requirement too low Much confident on own teaching To develop multi-ability of students Diverse modes of teaching	To complete textbook requirement Textbook requirement too high Less confident on own teaching Focus on teaching of knowledge (few teachers mentioned ability) Students would learn by teacher lecturing

Discussion

From the classroom observations and the schemes of work, it was found that teachers in both schools followed the national curriculum closely. In the rural school, teachers virtually followed the content in the textbook and the suggested teaching methods listed in the teacher reference book accompanying the textbook.

The two case studies revealed that teachers had strong influence on the ways the subject was planned and delivered at the instructional level. Their decisions on curriculum matters were shaped by their professional knowledge, educational beliefs, and the public examination.

In the rural school, teachers admitted that some students lagged behind in their studies. However, teachers did not attempt to vary the pace of teaching or tailor the curriculum content to cater for this less able group. Instead, teachers rushed through the curriculum just as suggested in the textbook. A major force pushing teachers adopted such stance was that their students were required to sit a "public examination" designed to monitor students' standard. The test items were set by a provincial or county agency according to the requirements of the national curriculum. This examination, though, did not affect the students, was a high stake test to the teachers because it affected their substantiation and promotion prospect.

This form of accountability control through public examination did make teachers adopt the curriculum. But in terms of effectiveness of teaching and learning, it is not highly desirable. The present study found that only a few teachers who had sound pedagogical content knowledge and positive teaching attitudes were willing and were able to adapt the national curriculum to meet the characteristics of their students.

Teacher development is, therefore, the key to successful curriculum change. In the two case schools, we found that the Chinese educational authority did attempt to help teachers enhance their knowledge and improve their skills. Teachers in the same school were required to meet and discuss their lesson plans periodically. In the urban school, this functioned fairly well. Mathematics teachers teaching the same year met periodically to discuss and plan their lessons together. The teachers also participated in the school-based research organized by the school. But this did not work so well in the rural school, as it was too small. To help the rural school teachers, the education authority organized some good lesson demonstrations at the "center school" for teachers in the same area to observe (Note 2). Through this, teachers had chances to exchange views and received more information about the new developments. However, this kind of professional development was far from adequate. In the rural school studied, teachers' qualification and their professional knowledge were far behind of their counterparts in the urban school. Most of the teachers were junior high school graduates and received only basic teacher training. The remoteness of the school and the lack of resources meant that the flow of information was restricted. To them, the only reference on the pedagogy of mathematics was the teacher reference book published by the textbook publisher.

These two case studies revealed clearly that there were marked differences between rural and urban school in Jilin. Using high stake examination to push teachers implement national curriculum was inexpensive and could generate "motivation" to work among teachers. However, the change was superficial. A single curriculum could not cater for the wide range of students. To make their teaching effective, teachers need to adapt the curriculum according to the demands of the school, the characteristics of the students, and the environmental setting of the school. We need high caliber, professional teachers to achieve this.

Conclusion

This paper reports the findings of two schools in Jilin province. Some interesting features have been identified which reflect the differences between schools in the urban and rural areas. The second author of this paper has extended the case study to two schools in rural and urban schools. The findings will be compared with the assertions revealed in the present study. It is hoped that by extending the case studies, deeper understanding of the implementation of planned curriculum in urban and rural areas could be generated.

Note

Note 1: ASFT-5: AS stands for School I; FT stands for interviews, 5 means that it was the fifth interview and 1 stands for tape 1.

Note 2: Center school is usually the largest and the best school in the rural area. It functions very much like a "big brother" to support the other schools in the area.

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